

approval is being sought must comply with § 33.200(c). The test engine must be configured with a complete airplane nacelle package, including engine-mounted equipment except for any configuration differences necessary to accommodate test stand interfaces with the engine nacelle package. At the conclusion of the test, the propulsion system must be:

(i) Visually inspected according to the applicant's on-wing inspection recommendations and limits.

(ii) Completely disassembled and the propulsion system hardware must be inspected in accordance with the service limits submitted in compliance with § 25.1529. Any potential sources of in-flight shutdown, loss of thrust control, or other power loss encountered during this inspection must be tracked and resolved in accordance with Section II, paragraph (b)(8) of this appendix.

(5) *New technology demonstration testing.* Testing must be conducted to substantiate the suitability of any technology new to the applicant, including substantially new manufacturing techniques.

(6) *APU validation test.* If utilizing an APU in order to meet the requirements of paragraph (a)(2) of section I of this appendix, one APU of the type to be certificated with the airplane must complete a test consisting of 3,000 equivalent airplane operational cycles. Following completion of the demonstration test, the APU must be disassembled and inspected. Any potential sources of in-flight start problems or run problems or both must be identified, tracked and resolved in accordance with Section II, paragraph (b)(8) of this appendix.

(7) *Airplane demonstration test.* For each airplane and engine combination to be certificated one or more airplanes must conduct flight-testing that demonstrates that the aircraft, its components and equipment are capable of and function properly during ETOPS and ETOPS diversions. This flight-testing may be coordinated with, but is not in place of flight-testing required for compliance to § 21.35(b)(2).

(i) The flight test program must include:

(A) Flights simulating actual ETOPS operation including normal cruise altitude, step climbs, and APU operations if paragraph (b)(2) of section I of this appendix applies.

(B) Demonstration of maximum normal flight duration with maximum diversion time for which eligibility is sought.

(C) Engine inoperative maximum time diversions to demonstrate the airplane and propulsion system capability to safely conduct an ETOPS diversion, including a repeat of a maximum continuous thrust (MCT) diversion on the same engine.

(D) Non-normal conditions to demonstrate the airplane's capability to safely conduct an ETOPS diversion under worst-case system failure conditions expected to occur in service.

(E) Diversions into representative operational diversionary airports.

(F) Repeated exposure to humid and inclement weather on the ground followed by long-range operations at normal cruise altitude.

(ii) The flight testing must validate the adequacy of the airplane's flying qualities,

performance and flight crew's ability to deal with the conditions of paragraphs (b)(7)(i)(C), (b)(7)(i)(D), and (b)(7)(i)(E) of Section II of this appendix.

(iii) The engine-inoperative diversions must be evenly distributed among the number of engines in the applicant's flight test program except as required by paragraph (b)(7)(i)(C) of Section II of this appendix.

(iv) The test airplane or airplanes must be operated and maintained using the recommended operations and maintenance manual procedures during the airplane demonstration test.

(v) At the completion of the airplane or airplanes demonstration testing, the ETOPS significant systems must undergo an airplane visual inspection per the Instructions for Continued Airworthiness of § 25.1529. The engines must also undergo a gas path inspection. These inspections are intended to identify any abnormal conditions that could result in an in-flight shutdown or diversion. Any abnormal conditions must be identified, tracked and resolved in accordance with paragraph (b)(8) of Section II of this appendix.

(8) *Problem tracking and resolution system.* A problem tracking and resolution system must be established to address problems, as identified in § 21.4(a)(5), encountered on the ETOPS significant systems during airplane and engine testing that could affect the safety of ETOPS operations. If the airplane or engine type certificated is a derivative of a previously certificated airplane or engine, the criteria of § 21.4(a)(4) may apply.

(i) The system must contain a means for prompt identification of problems that could impact the safety of ETOPS operations.

(ii) The system must contain the process for the timely notification to the responsible FAA office of all relevant problems encountered, and corrective actions deemed necessary, in a manner that allows for appropriate FAA review of all planned corrective actions.

(iii) The system must be in effect during the phases of airplane and engine development that will be used to assess early ETOPS eligibility.

(iv) Upon Type Certification, the certificate holder must comply with problem tracking and resolution system requirements of § 21.4.

(9) *Reliability demonstration acceptance criteria.* For airplane, propulsion and ETOPS significant systems, the type and frequency of failures that occur during the airplane flight test program and the airplane demonstration test required by paragraph (b)(7) of Section II of this appendix must be consistent with the type and frequency of failures or malfunctions that would be expected to occur on presently certified ETOPS airplanes.

(c) *Combined service experience and early ETOPS method.*

(1) The in-service experience requirements of paragraph (a)(1) may be reduced to 15,000 engine hours provided compliance to paragraphs (a)(5), (b)(1), (b)(2), (b)(3), (b)(4), (b)(5), (b)(6), (b)(8), and (b)(9) of Section II of this appendix have been met.

(2) Additionally, as allowed by § 21.21(b)(1), the in-service experience requirements of paragraph (a)(1) of Section II of this appendix may be reduced to some

level other than 15,000 engine hours provided compensating factors that provide an equivalent level of safety are provided.

Section III—Airplanes With More Than Two Engines

An applicant for an airplane with more than two engines must use one of the methods described in the following paragraphs (a), (b) or (c) of Section III of this appendix to certify the airplane for Extended Operations.

(a) *Service experience method.* The applicant must demonstrate that the airplane and engine combination for which approval is sought has the required airplane and propulsion system capability to safely conduct an ETOPS mission and maximum diversion and has achieved required airplane system reliability based upon fleet in-service experience.

(1) *Required service experience.* After accumulating 250,000 worldwide fleet engine hours on the airplane and engine combination for which approval is sought, the applicant must perform a reliability review. The number of hours may be reduced if adequate compensating factors are identified which give a reasonable equivalent database. Where experience on another airplane is applicable, a significant portion of the 250,000 hours must be obtained on the candidate airplane.

(2) *Airplane systems assessment.* Airplane systems must comply with the requirements of § 25.1535(a) using available in-service reliability data for ETOPS significant systems. All causes or potential causes of ETOPS significant system failures occurring in service must have corrective actions that are shown to be effective in preventing future occurrences.

(3) *Airplane flight test requirements.* The applicant must conduct a flight test to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to deal with engine inoperative and non-normal worst case system failure conditions expected to occur in service.

(b) *Early ETOPS method.*

(1) *Maintenance and operational procedures.* The applicant must validate all ETOPS Significant Systems maintenance and operational procedures. The applicant must track and resolve any problems found as a result of the validation through the Problem Tracking and Resolution System required by paragraph (b)(5) of Section III of this appendix.

(2) *New technology demonstration testing.* The applicant must conduct testing to substantiate the suitability of any technology new to the applicant, including substantially new manufacturing techniques.

(3) *APU validation test.* If utilizing an APU in order to meet the requirements of paragraph (a)(2) of section I of this appendix, one APU of the type to be certificated with the airplane must complete a test consisting of 3,000 equivalent airplane operational cycles. Following completion of the demonstration test, the APU must be disassembled and inspected. Any potential sources of in-flight start problems or run problems or both must be identified, tracked and resolved in accordance with paragraph (b)(5) of Section III of this appendix.